Appendix B

Air Quality Calculations

Summary of Maximum Daily Construction Emissions from Marker Balls (MB) and Tower Crew Combined with Final EIS Values[a]

Jurisdiction		Emissions (lbs/day)					
		VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
SCAQMD	FEIS Maximum Daily[b]	333	1,315	1,465	10	574	188
	MB/Tower Crew Maximum Daily	19.42	31.39	44.82	0.22	49.70	10.44
	TOTAL	352	1,346	1,510	10	624	198
	SCAQMD CEQA THRESHOLD[c]	75	550	100	150	150	55
	FEIS Exceeds (YES/NO)[b]	YES	YES	YES	NO	YES	YES
	FEIS + Additional Exceeds (YES/NO)	YES	YES	YES	NO	YES	YES
AVAQMD	FEIS Maximum Daily[b]	405	1,506	1,669	12	365	138
	MB/Tower Crew Maximum Daily	19.42	31.39	44.82	0.22	49.70	10.44
	TOTAL	424	1,537	1,714	12	415	148
	AVAQMD CEQA THRESHOLD[d]	137	548	137	137	82	--
	FEIS Exceeds (YES/NO)[b]	YES	YES	YES	NO	YES	--
	FEIS + Additional Exceeds (YES/NO)	YES	YES	YES	NO	YES	--

[a] Maximum daily values include all construction emissions within each air district, regardless of whether those emissions occurred on or off federal lands.

[b] Emissions and results from Final EIR Table 3.3-18 (October 2009) and Final EIS Table 3.3-18 (September 2010).

[c] Source: SCAQMD. 2010. Air Quality Analysis Handbook. [online]: http://www.aqmd.gov/ceqa/hdbk.html. Accessed July 2010.

[d] Source: AVAQMD. 2005. California Environmental Quality Act (CEQA) and Federal Conformity Guidelines. May.

AVAQMD - Antelope Valley Air Quality Management District
CO – carbon monoxide
lbs/day – pounds per day
NOx – nitrogen oxide
PM10 – particulate matter less than 10 micrometers in aerodynamic diameter
PM2.5 – particulate matter less than 2.5 micrometers in aerodynamic diameter
SCAQMD - South Coast Air Quality Management District
SOx – sulfur oxide
VOC – volatile organic compound

Emissions from Markerball Installation and Specialized Crew Used for Tower Lighting Wiring/Testing

Total: Annual Emissions Combined

Construction Year	Emissions (tons/yr)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
All	1.14	1.83	2.63	0.01	2.91	0.61

Total: Daily Emissions Combined

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2012	19.42	31.39	44.82	0.22	49.70	10.44
2013	19.42	31.39	44.82	0.22	49.70	10.44
2014	19.42	31.39	44.82	0.22	49.70	10.44
2015	19.42	31.39	44.82	0.22	49.70	10.44

Calculations assume a maximum of 20 markerballs installed per day so daily emissions for marker ball installation would be the same every year.

Calculations assume one tower crew per day so daily emissions for tower construction would be the same every year.

ANF Land: Emissions Combined

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2013	19.18	29.55	43.63	0.22	47.25	9.98
2014	19.42	31.39	44.82	0.22	49.70	10.44
2015	19.18	29.55	43.63	0.22	47.25	9.98
Construction Year	**Emissions (tons/year)**					
	VOC	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
2013	0.28	0.44	0.64	0.00	0.70	0.15
2014	0.21	0.33	0.48	0.00	0.53	0.11
2015	0.09	0.14	0.21	0.00	0.23	0.05

Calculations assume a maximum of 20 markerballs installed per day so daily emissions for marker ball installation would be the same every year.

Calculations assume one tower crew per day so daily emissions for tower construction would be the same every year.

Summary Emissions from Specialized Crew Used for Tower Lighting Wiring/Testing

Total: Annual Emissions for Specialized Crew for Tower Lighting Wiring/Testing

Construction Year	Emissions (tons/yr)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
ALL	0.01	0.08	0.05	0.00	0.11	0.02

Total: Daily Emissions for Specialized Crew for Tower Lighting Wiring/Testing

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2012	0.23	1.84	1.19	0.00	2.45	0.47
2013	0.23	1.84	1.19	0.00	2.45	0.47
2014	0.23	1.84	1.19	0.00	2.45	0.47
2015	0.23	1.84	1.19	0.00	2.45	0.47

Calculations assume one tower crew per day so daily emissions would be the same every year.

ANF Land: Emissions for Specialized Crew

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2014	0.23	1.84	1.19	0.00	2.45	0.47
Construction Year	Emissions (tons/year)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2014	0.0009	0.0074	0.0048	0.0000	0.0098	0.0019

Calculations assume one tower crew per day so daily emissions would be the same every year.

Summary of Number of Red Lights Installed by Segment

Segment	Year	Total Number of Red Lights	Number of Red Lights on ANF Land	Number of Red Lights on USACE Land
5	All	11	0	0
6	All	2	0	0
7	All	24	0	4
8	All	46	0	5
10	All	1	0	0
11	2014	8	8	0

It was assumed that 1 tower per day would have red lights installed by the specialized crew.

Data based on table in file called "TRTP 4_11 Summary 031212 R120_CPUC_Response-Rev 2.xlsx" and schedule information provided by Babak Baradaran\SCE on April 3, 2012.

Summary Emissions from Markerball Installation

Total: Annual Emissions for Marker Ball Installation

Construction Year	Emissions (tons/yr)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
ALL	1.13	1.75	2.58	0.01	2.79	0.59

Total: Daily Emissions for Marker Ball Installation

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2012	19.18	29.55	43.63	0.22	47.25	9.98
2013	19.18	29.55	43.63	0.22	47.25	9.98
2014	19.18	29.55	43.63	0.22	47.25	9.98
2015	19.18	29.55	43.63	0.22	47.25	9.98

Calculations assume a maximum of 20 markerballs installed per day so daily emissions would be the same every year.

ANF Land: Emissions for Marker Ball Installation

Construction Year	Emissions (lbs/day)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2013	19.18	29.55	43.63	0.22	47.25	9.98
2014	19.18	29.55	43.63	0.22	47.25	9.98
2015	19.18	29.55	43.63	0.22	47.25	9.98
Construction Year	Emissions (tons/year)					
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
2013	0.28	0.44	0.64	0.00	0.70	0.15
2014	0.21	0.32	0.48	0.00	0.52	0.11
2015	0.09	0.14	0.21	0.00	0.23	0.05

Calculations assume a maximum of 20 markerballs installed per day so daily emissions would be the same every year.

Summary of Number of Marker Balls Installed by Segment

Segment	Year	Number of Marker Balls	of Marker Balls on ANF Land	of Marker Balls on
5	All	186	0	0
6	All	654	596	0
7	All	253	0	54
8	All	629	0	23
11	All	643	625	0

It was assumed that 20 marker balls would be installed each day.
R120_CPUC_Response-Rev 2.xlsx".

Annual Summary of Number of Marker Balls Installed in the ANF

Year	Number of Marker Balls on ANF Land
2013	591
2014	439
2015	191

Provided by Babak Baradaran\SCE on April 3, 2012. Data based on table in file called "TRTP 4_11 Summary 031212 R120_CPUC_Response-Rev 2.xlsx" and most recent schedule information.

Emissions from Marker Ball Installation

Summary - Daily Emissions from Markerball Installation

Emission Type	Exhaust Emissions (lbs/day)						Fugitive Dust Emissions (lbs/day)	
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Direct Emissions	18.824	26.077	43.273	0.211	2.159	2.024	39.702	6.710
Indirect Emissions	0.358	3.470	0.355	0.005	0.037	0.024	5.354	1.217
TOTAL	19.182	29.548	43.628	0.215	2.197	2.048	45.057	7.928

Calculations assume 20 markerballs are installed per day.
commutes.

Emission Calculations (Fugitive Dust, Onroad, and Helicopter)

I. Fugitive Dust Emission Categories
1) Earthmoving
2) Road Dust Paved/Unpaved

1) Earthmoving
No earthmoving

2) Road Dust
Emission Types
A) Paved Road Dust
B) Unpaved Road Dust

A) Paved Road Dust

E = [k x (sL/2)0.65 x (W/3)1.5 -C] x (1-P/4N)
E = lb/VMT
k = Constant (0.016 for PM10 and 0.0040 for PM2.5)
sL = Silt Loading (assumed to be 0.06 g/m2 - assumes 5,000 to 10,000 ADT profile of Table 13.2.1-3 average for all traffic)
W = Average weight of vehicles in tons (calculated below)
C = Correction for exhaust, break wear, tire wear (0.00047 lb/VMT for PM10, 0.00036 lb/VMT for PM2.5)
p = Number of wet days (no correction for number of wet days due to assumption of working in dry season)

Average Vehicle Weight Calculation
Assumptions
Passenger Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 8 ton average
Heavy-Heavy Duty Trucks = 30 tons average (loaded 40 tons, unloaded 20 tons)
Daily VMT

Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
420	360	300	1,080	11.78

Emission Factors and Emissions
Emission Factors

lb PM10/VMT	lb PM2.5/VMT
0.0123	0.0028

Emissions lbs/day

PM10	PM2.5	
8.10	1.86	Direct
5.15	1.19	Indirect

Direct emissions include emissions from delivery/work vehicles and heavy-heavy duty vehicles. Indirect emissions include emissions from worker commutes.

B) Unpaved Road Dust

$E = (k)[(s/12)^{0.9}][(W/3)^{0.45}][(365-P)/365]$ (for industrial sites)

k = constant = 1.5 lb/VMT for PM10 and 0.23 lb/VMT for PM2.5
s = Silt Content (assumed to be 12% - SCAQMD Handbook for Mountain Roads)
W = avg. vehicle weight = calculated below
p = Number of wet days (no correction for number of wet days due to assumption of working in dry season)

Average Vehicle Weight Calculation

Assumptions
Personal/Professionals/inspection Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 8 ton average
Heavy-Heavy Duty Trucks = 30 tons average (loaded 40 tons, unloaded 20 tons)

Daily VMT

Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
1	60	50	111	17.90

Uncontrolled Emission Factors and Emissions
Emission Factors (lb/VMT)

PM10	PM2.5
1.80	0.28

Emissions lbs/day

PM10	PM2.5	
197.53	30.29	Direct
1.26	0.19	Indirect

Controlled Emissions (assumes 84% efficiency with use of soil binder)

Emission Factors (lb/VMT) Emission Control Efficiency 84%

PM10	PM2.5
0.29	0.04

Controlled Emissions lbs/day

PM10	PM2.5	
31.60	4.85	Direct
0.20	0.03	Indirect

Direct emissions include emissions from delivery/work vehicles and heavy-heavy duty vehicles. Indirect emissions include emissions from worker commutes.

II. Onroad Vehicle Emissions - Daily Vehicle Use								Emissions (lb/day)						Emissions (lb/day)					
Activity	**QUANTITY**	**TYPE**	**Heavy Duty Truck Miles Traveled per Day - Paved Roads**	**Heavy Duty Truck Miles Traveled per Day - Unpaved Roads**	**# WORKERS PER DAY**	**Worker Miles Traveled per Day - Paved Roads**	**Worker Miles Traveled per Day - Unpaved Roads**	**VOC**	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
Marker Ball Installation		Worker Commute			7	60	0.1	0.358	3.470	0.355	0.00453	0.03729	0.02374	-	-	-	-	-	-
	1	Mechanic/Fuel Truck	60	10				-	-	-	-	-	-	0.196	0.779	2.419	0.003	0.116	0.101
	1	Haul Truck	60	10				-	-	-	-	-	-	0.196	0.779	2.419	0.003	0.116	0.101
	1	Monitor Truck	60	10				-	-	-	-	-	-	0.169	1.185	1.325	0.002	0.049	0.042
	1	Fire Truck	60	10				-	-	-	-	-	-	0.196	0.779	2.419	0.003	0.116	0.101
	2	Water Trucks	60	10				-	-	-	-	-	-	0.391	1.557	4.838	0.006	0.233	0.202
	2	Pickup - 1 Ton	60	10				-	-	-	-	-	-	0.391	1.557	4.838	0.006	0.233	0.202
	3	Additional Trucks	60	10				-	-	-	-	-	-	0.508	3.556	3.976	0.006	0.147	0.125
							TOTAL (lbs/day)	0.358	3.470	0.355	0.005	0.037	0.024	2.047	10.192	22.235	0.027	1.010	0.875

1. Calculations assume exhaust emissions from worker commutes are indirect emissions and that emissions from trucks are direct emissions.

2. Calculations assume the specialized crew would travel from a staging area to the work site (at the tower) with the tower crew so there would no additional trips to the tower.

III. Helicopter Emissions - Daily Use								
Helicopter Type	**Daily Working Hours**	**Daily Idle Hours**	**Emissions (lb/day)**					
			VOC	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
Hughes 500	7	3	16.78	15.89	21.04	0.18	1.15	1.15

It was assumed in a 10-hour workday that the helicopter would operate for 7 hours and would be idle for 3 hours.

Emissions from Specialized Crew Used for Tower Lighting Wiring/Testing

Summary - Daily Emissions from Specialized Crew for Tower Lighting

Emission Type	Exhaust Emissions (lbs/day)						Fugitive Dust Emissions (lbs/day)	
	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Direct Emissions	0.144	0.985	1.104	0.002	0.042	0.035	2.110	0.342
Indirect Emissions	0.090	0.852	0.086	0.001	0.011	0.007	0.286	0.082
TOTAL	0.234	1.838	1.190	0.003	0.053	0.042	2.395	0.424

trucks trips. No additional off-road equipment or helicopters would be needed for tower lighting.

2. Calculations assume the specialized crew would work one day per tower.

Emissions from Specialized Crew Used for Tower Lighting Wiring/Testing

Emission Calculations (Fugitive Dust and Onroad)

I. Fugitive Dust Emission Categories

1) Earthmoving
2) Road Dust Paved/Unpaved

1) Earthmoving

No earthmoving

2) Road Dust

Emission Types
A) Paved Road Dust
B) Unpaved Road Dust

A) Paved Road Dust

E = [k x (sL/2)0.65 x (W/3)1.5 -C] x (1-P/4N)
E = lb/VMT
k = Constant (0.016 for PM10 and 0.0040 for PM2.5)
sL = Silt Loading (assumed to be 0.06 g/m2 - assumes 5,000 to 10,000 ADT profile of Table 13.2.1-3 average for all traffic)
W = Average weight of vehicles in tons (calculated below)
C = Correction for exhaust, break wear, tire wear (0.00047 lb/VMT for PM10, 0.00036 lb/VMT for PM2.5)
p = Number of wet days (no correction for number of wet days due to assumption of working in dry season)

Average Vehicle Weight Calculation
Assumptions
Passenger Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 8 ton average
Heavy-Heavy Duty Trucks = 30 tons average (loaded 40 tons, unloaded 20 tons)
Daily VMT

Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
120	60	0	180	4.00

Emission Factors and Emissions
Emission Factors

lb PM10/VMT	lb PM2.5/VMT
0.0021	0.0006

Emissions lbs/day

PM10	PM2.5	
0.12	0.04	Direct
0.25	0.08	Indirect

Direct emissions include emissions from delivery/work vehicles. Indirect emissions include emissions from worker commutes.

B) Unpaved Road Dust

E = $(k)[(s/12)^{0.9}][(W/3)^{0.45}][(365-P)/365]$ (for industrial sites)

k = constant = 1.5 lb/VMT for PM10 and 0.23 lb/VMT for PM2.5
s = Silt Content (assumed to be 12% - SCAQMD Handbook for Mountain Roads)
W = avg. vehicle weight = calculated below
p = Number of wet days (no correction for number of wet days due to assumption of working in dry season)

Average Vehicle Weight Calculation

Assumptions
Personal/Professionals/inspection Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 8 ton average
Heavy-Heavy Duty Trucks = 30 tons average (loaded 40 tons, unloaded 20 tons)

Daily VMT

Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
0.2	10	0	10	7.88

Uncontrolled Emission Factors and Emissions
Emission Factors (lb/VMT)

PM10	PM2.5
1.24	0.19

Emissions lbs/day

PM10	PM2.5	
12.42	1.90	Direct
0.25	0.04	Indirect

Controlled Emissions (assumes 84% efficiency with use of soil binder)

Emission Factors (lb/VMT)

PM10	PM2.5
0.20	0.03

Emission Control Efficiency
84%

Controlled Emissions lbs/day

PM10	PM2.5	
1.99	0.30	Direct
0.04	0.01	Indirect

Direct emissions include emissions from delivery/work vehicles. Indirect emissions include emissions from worker commutes.

Emissions from Specialized Crew Used for Tower Lighting Wiring/Testing

II. Onroad Vehicle Emissions - Daily Vehicle Use								Emissions (lb/day)						Emissions (lb/day)					
Activity	QUANTITY	TYPE	Light Duty Truck Miles Traveled per Day - Paved Roads	Light Duty Truck Miles Traveled per Day - Unpaved Roads	# WORKERS PER DAY	Worker Miles Traveled per Day - Paved Roads	Worker Miles Traveled per Day - Unpaved Roads	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$
Specialized Tower Crew (wiring/testing)		Worker Commute			2	60	0.1	0.090	0.852	0.086	0.001	0.011	0.007	-	-	-	-	-	-
	1	Light Duty 3/4 Ton Truck	60	10				-	-	-	-	-	-	0.144	0.985	1.104	0.002	0.042	0.035
							TOTAL (lbs/day)	0.090	0.852	0.086	0.001	0.011	0.007	0.144	0.985	1.104	0.002	0.042	0.035

1. Calculations assume that equipment (lights, solar, and battery) would be installed on structure body after erecting the tower.
2. Calculations assume the specialized crew would travel from a staging area to the work site (at the tower) with the tower crew so there would no additional trips to the tower.
3. Calculations assume the specialized crew would work in the year 2013.
4. Calculations assume the same specialized crew would wire/test the six towers and each tower would take one day.

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model and extracting the **Heavy-Heavy-Duty Diesel Truck (HHDT)** Emission Factors.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle/emission categories listed in the tables below, by use of the following equation:

Emissions (pounds per day) = N x TL x EF

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

The **HHDT-DSL** vehicle/emission category accounts for all emissions from heavy-heavy-duty diesel trucks, including start, running and idling exhaust. In addition, ROG emission factors account for diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors account for tire and brake wear.

The **HHDT-DSL, Exh** vehicle/emission category includes only the exhaust portion of PM10 & PM2.5 emissions from heavy-heavy-duty diesel trucks.

Scenario Year: **2011**

All model years in the range 1967 to 2011

HHDT-DSL (pounds/mile)	
CO	**0.01112463**
NOx	**0.03455809**
ROG	**0.00279543**
SOx	**0.00003972**
PM10	**0.00166087**
PM2.5	**0.00144489**
CO2	**4.22045680**
CH4	**0.00012910**

HHDT-DSL, Exh (pounds/mile)	
PM10	**0.00151936**
PM2.5	**0.00139772**

Scenario Year: **2012**

All model years in the range 1968 to 2012

HHDT-DSL (pounds/mile)	
CO	**0.01021519**
NOx	**0.03092379**
ROG	**0.00252764**
SOx	**0.00004042**
PM10	**0.00149566**
PM2.5	**0.00129354**
CO2	**4.21590774**
CH4	**0.00011651**

HHDT-DSL, Exh (pounds/mile)	
PM10	**0.00135537**
PM2.5	**0.00124837**

Scenario Year: **2013**

All model years in the range 1969 to 2013

HHDT-DSL (pounds/mile)	
CO	**0.00931790**
NOx	**0.02742935**
ROG	**0.00226308**
SOx	**0.00004086**
PM10	**0.00133697**
PM2.5	**0.00114629**
CO2	**4.21518556**
CH4	**0.00010441**

HHDT-DSL, Exh (pounds/mile)	
PM10	**0.00119623**
PM2.5	**0.00109863**

Scenario Year: **2014**

All model years in the range 1970 to 2014

HHDT-DSL (pounds/mile)	
CO	**0.00846435**
NOx	**0.02418049**
ROG	**0.00201594**
SOx	**0.00004092**
PM10	**0.00118458**
PM2.5	**0.00100582**
CO2	**4.21279345**
CH4	**0.00009261**

HHDT-DSL, Exh (pounds/mile)	
PM10	**0.00104243**
PM2.5	**0.00096059**

Scenario Year: **2015**

All model years in the range 1971 to 2015

(pounds/mile)	
CO	**0.00766891**
NOx	**0.02122678**
ROG	**0.00178608**
SOx	**0.00004082**
PM10	**0.00104715**
PM2.5	**0.00087977**
CO2	**4.20902225**
CH4	**0.00008369**

(pounds/mile)	
PM10	**0.00090631**
PM2.5	**0.00083282**

Scenario Year: **2016**

All model years in the range 1972 to 2016

(pounds/mile)	
CO	**0.00704604**
NOx	**0.01887374**
ROG	**0.00161035**
SOx	**0.00003952**
PM10	**0.00094448**
PM2.5	**0.00078443**
CO2	**4.21063031**
CH4	**0.00007508**

(pounds/mile)	
PM10	**0.00080419**
PM2.5	**0.00073898**

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

Scenario Year: **2017**

All model years in the range 1973 to 2017

(pounds/mile)	
CO	**0.00650533**
NOx	**0.01690387**
ROG	**0.00145203**
SOx	**0.00004033**
PM10	**0.00084894**
PM2.5	**0.00069721**
CO2	**4.20820129**
CH4	**0.00006722**

(pounds/mile)	
PM10	**0.00070873**
PM2.5	**0.00065111**

Scenario Year: **2018**

All model years in the range 1974 to 2018

(pounds/mile)	
CO	**0.00604721**
NOx	**0.01526414**
ROG	**0.00131697**
SOx	**0.00003934**
PM10	**0.00076808**
PM2.5	**0.00062383**
CO2	**4.20756838**
CH4	**0.00006182**

(pounds/mile)	
PM10	**0.00062758**
PM2.5	**0.00057700**

Scenario Year: **2019**

All model years in the range 1975 to 2019

(pounds/mile)	
CO	**0.00565433**
NOx	**0.01389113**
ROG	**0.00120235**
SOx	**0.00004032**
PM10	**0.00070198**
PM2.5	**0.00056085**
CO2	**4.20637830**
CH4	**0.00005499**

(pounds/mile)	
PM10	**0.00056085**
PM2.5	**0.00051320**

Scenario Year: **2020**

All model years in the range 1976 to 2020

(pounds/mile)	
CO	**0.00532242**
NOx	**0.01274755**
ROG	**0.00110621**
SOx	**0.00003957**
PM10	**0.00064574**
PM2.5	**0.00050904**
CO2	**4.20541416**
CH4	**0.00005216**

(pounds/mile)	
PM10	**0.00050364**
PM2.5	**0.00046227**

Scenario Year: **2021**

All model years in the range 1977 to 2021

(pounds/mile)	
CO	**0.00503726**
NOx	**0.01179977**
ROG	**0.00103095**
SOx	**0.00004033**
PM10	**0.00059437**
PM2.5	**0.00046287**
CO2	**4.21495573**
CH4	**0.00004734**

(pounds/mile)	
PM10	**0.00045411**
PM2.5	**0.00041729**

Scenario Year: **2022**

All model years in the range 1978 to 2022

(pounds/mile)	
CO	**0.00478830**
NOx	**0.01098794**
ROG	**0.00096142**
SOx	**0.00004106**
PM10	**0.00055427**
PM2.5	**0.00042597**
CO2	**4.21520828**
CH4	**0.00004448**

(pounds/mile)	
PM10	**0.00041399**
PM2.5	**0.00037807**

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks
Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

Scenario Year: **2023**

All model years in the range 1979 to 2023

(pounds/mile)	
CO	**0.00457902**
NOx	**0.01031407**
ROG	**0.00090210**
SOx	**0.00004009**
PM10	**0.00052122**
PM2.5	**0.00039592**
CO_2	**4.21483461**
CH_4	**0.00004176**

(pounds/mile)	
PM10	**0.00037922**
PM2.5	**0.00034915**

Scenario Year: **2024**

All model years in the range 1980 to 2024

(pounds/mile)	
CO	**0.00444444**
NOx	**0.00974372**
ROG	**0.00084009**
SOx	**0.00003930**
PM10	**0.00050766**
PM2.5	**0.00038320**
CO_2	**4.19552935**
CH_4	**0.00003930**

(pounds/mile)	
PM10	**0.00036682**
PM2.5	**0.00033735**

Scenario Year: **2025**

All model years in the range 1981 to 2025

(pounds/mile)	
CO	**0.00431086**
NOx	**0.00932573**
ROG	**0.00080206**
SOx	**0.00004018**
PM10	**0.00048541**
PM2.5	**0.00036326**
CO_2	**4.19512979**
CH_4	**0.00003697**

(pounds/mile)	
PM10	**0.00034397**
PM2.5	**0.00031664**

Scenario Year: **2026**

All model years in the range 1982 to 2026

(pounds/mile)	
CO	**0.00420297**
NOx	**0.00898990**
ROG	**0.00077178**
SOx	**0.00003946**
PM10	**0.00046717**
PM2.5	**0.00034564**
CO_2	**4.19349747**
CH_4	**0.00003630**

(pounds/mile)	
PM10	**0.00032670**
PM2.5	**0.00029830**

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model, taking the weighted average of vehicle types and simplifying into two categories:

Passenger Vehicles & Delivery Trucks.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle categories listed in the tables below, by use of the following equation:

Emissions (pounds per day) = N x TL x EF

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

This methodology replaces the old EMFAC emission factors in Tables A-9-5-J-1 through A-9-5-L in Appendix A9 of the current SCAQMD CEQA Handbook. All the emission factors account for the emissions from start, running and idling exhaust. In addition, the ROG emission factors include diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors include tire and brake wear.

Scenario Year: **2011**

All model years in the range 1967 to 2011

Passenger Vehicles (pounds/mile)	
CO	0.00826276
NOx	0.00084460
ROG	0.00085233
SOx	0.00001077
PM10	0.00008879
PM2.5	0.00005653
CO2	1.10235154
CH4	0.00007678

Delivery Trucks (pounds/mile)	
CO	0.01693242
NOx	0.01893366
ROG	0.00241868
SOx	0.00002728
PM10	0.00070097
PM2.5	0.00059682
CO2	2.75180822
CH4	0.00011655

Scenario Year: **2012**

All model years in the range 1968 to 2012

Passenger Vehicles (pounds/mile)	
CO	0.00765475
NOx	0.00077583
ROG	0.00079628
SOx	0.00001073
PM10	0.00008979
PM2.5	0.00005750
CO2	1.10152540
CH4	0.00007169

Delivery Trucks (pounds/mile)	
CO	0.01545741
NOx	0.01732423
ROG	0.00223776
SOx	0.00002667
PM10	0.00064975
PM2.5	0.00054954
CO2	2.76628414
CH4	0.00010668

Scenario Year: **2013**

All model years in the range 1969 to 2013

Passenger Vehicles (pounds/mile)	
CO	0.00709228
NOx	0.00071158
ROG	0.00074567
SOx	0.00001072
PM10	0.00009067
PM2.5	0.00005834
CO2	1.10087435
CH4	0.00006707

Delivery Trucks (pounds/mile)	
CO	0.01407778
NOx	0.01577311
ROG	0.00206295
SOx	0.00002682
PM10	0.00059956
PM2.5	0.00050174
CO2	2.78163459
CH4	0.00009703

Scenario Year: **2014**

All model years in the range 1970 to 2014

Passenger Vehicles (pounds/mile)	
CO	0.00660353
NOx	0.00065484
ROG	0.00070227
SOx	0.00001069
PM10	0.00009185
PM2.5	0.00005939
CO2	1.10257205
CH4	0.00006312

Delivery Trucks (pounds/mile)	
CO	0.01284321
NOx	0.01425162
ROG	0.00189649
SOx	0.00002754
PM10	0.00054929
PM2.5	0.00045519
CO2	2.79845465
CH4	0.00008798

Scenario Year: **2015**

All model years in the range 1971 to 2015

Passenger Vehicles (pounds/mile)	
CO	0.00614108
NOx	0.00060188
ROG	0.00066355
SOx	0.00001070
PM10	0.00009259
PM2.5	0.00006015
CO2	1.10192837
CH4	0.00005923

Delivery Trucks (pounds/mile)	
CO	0.01169445
NOx	0.01285026
ROG	0.00173890
SOx	0.00002741
PM10	0.00050307
PM2.5	0.00041268
CO2	2.81247685
CH4	0.00008076

Scenario Year: **2016**

All model years in the range 1972 to 2016

Passenger Vehicles (pounds/mile)	
CO	0.00575800
NOx	0.00055658
ROG	0.00063254
SOx	0.00001071
PM10	0.00009392
PM2.5	0.00006131
CO2	1.10677664
CH4	0.00005623

Delivery Trucks (pounds/mile)	
CO	0.01080542
NOx	0.01172881
ROG	0.00161521
SOx	0.00002767
PM10	0.00046606
PM2.5	0.00037868
CO2	2.83134285
CH4	0.00007355

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

Scenario Year: **2017**

All model years in the range 1973 to 2017

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00537891**	CO	**0.00998101**
NOx	**0.00051297**	NOx	**0.01070034**
ROG	**0.00060109**	ROG	**0.00150242**
SOx	**0.00001079**	SOx	**0.00002723**
PM10	**0.00009446**	PM10	**0.00043131**
PM2.5	**0.00006192**	PM2.5	**0.00034605**
CO2	**1.10627489**	CO2	**2.84005015**
CH4	**0.00005300**	CH4	**0.00006663**

Scenario Year: **2018**

All model years in the range 1974 to 2018

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00502881**	CO	**0.00923234**
NOx	**0.00047300**	NOx	**0.00979416**
ROG	**0.00057178**	ROG	**0.00139856**
SOx	**0.00001071**	SOx	**0.00002749**
PM10	**0.00009494**	PM10	**0.00040110**
PM2.5	**0.00006234**	PM2.5	**0.00031792**
CO2	**1.10562643**	CO2	**2.84646835**
CH4	**0.00005003**	CH4	**0.00006203**

Scenario Year: **2019**

All model years in the range 1975 to 2019

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00471820**	CO	**0.00857192**
NOx	**0.00043716**	NOx	**0.00900205**
ROG	**0.00054654**	ROG	**0.00130563**
SOx	**0.00001072**	SOx	**0.00002706**
PM10	**0.00009523**	PM10	**0.00037393**
PM2.5	**0.00006259**	PM2.5	**0.00029276**
CO2	**1.10496100**	CO2	**2.85060182**
CH4	**0.00004743**	CH4	**0.00005619**

Scenario Year: **2020**

All model years in the range 1976 to 2020

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00444247**	CO	**0.00799617**
NOx	**0.00040506**	NOx	**0.00831802**
ROG	**0.00052463**	ROG	**0.00122382**
SOx	**0.00001073**	SOx	**0.00002733**
PM10	**0.00009550**	PM10	**0.00035054**
PM2.5	**0.00006279**	PM2.5	**0.00027128**
CO2	**1.10456157**	CO2	**2.85148109**
CH4	**0.00004495**	CH4	**0.00005330**

Scenario Year: **2021**

All model years in the range 1977 to 2021

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00421218**	CO	**0.00748303**
NOx	**0.00037757**	NOx	**0.00773500**
ROG	**0.00050573**	ROG	**0.00115568**
SOx	**0.00001073**	SOx	**0.00002755**
PM10	**0.00009640**	PM10	**0.00033125**
PM2.5	**0.00006364**	PM2.5	**0.00025331**
CO2	**1.11009559**	CO2	**2.86434187**
CH4	**0.00004322**	CH4	**0.00004905**

Scenario Year: **2022**

All model years in the range 1978 to 2022

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	**0.00397866**	CO	**0.00699290**
NOx	**0.00035150**	NOx	**0.00722470**
ROG	**0.00048658**	ROG	**0.00108569**
SOx	**0.00001072**	SOx	**0.00002774**
PM10	**0.00009661**	PM10	**0.00031501**
PM2.5	**0.00006389**	PM2.5	**0.00023906**
CO2	**1.11019931**	CO2	**2.87006769**
CH4	**0.00004121**	CH4	**0.00004557**

Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks
Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks
Projects in the SCAQMD (Scenario Years 2007 - 2026)
Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

Vehicle Class:
Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

Scenario Year: **2023**

All model years in the range 1979 to 2023

Passenger Vehicles (pounds/mile)	
CO	**0.00377527**
NOx	**0.00032851**
ROG	**0.00046900**
SOx	**0.00001070**
PM10	**0.00009676**
PM2.5	**0.00006405**
CO2	**1.11023373**
CH4	**0.00003951**

Delivery Trucks (pounds/mile)	
CO	**0.00658123**
NOx	**0.00679147**
ROG	**0.00102852**
SOx	**0.00002790**
PM10	**0.00030109**
PM2.5	**0.00022582**
CO2	**2.87466338**
CH4	**0.00004218**

Scenario Year: **2024**

All model years in the range 1980 to 2024

Passenger Vehicles (pounds/mile)	
CO	**0.00358611**
NOx	**0.00030721**
ROG	**0.00045136**
SOx	**0.00001080**
PM10	**0.00009676**
PM2.5	**0.00006410**
CO2	**1.11061572**
CH4	**0.00003781**

Delivery Trucks (pounds/mile)	
CO	**0.00625076**
NOx	**0.00647083**
ROG	**0.00096578**
SOx	**0.00002807**
PM10	**0.00029407**
PM2.5	**0.00021880**
CO2	**2.88010717**
CH4	**0.00004019**

Scenario Year: **2025**

All model years in the range 1981 to 2025

Passenger Vehicles (pounds/mile)	
CO	**0.00342738**
NOx	**0.00028846**
ROG	**0.00043545**
SOx	**0.00001070**
PM10	**0.00009679**
PM2.5	**0.00006418**
CO2	**1.11078571**
CH4	**0.00003641**

Delivery Trucks (pounds/mile)	
CO	**0.00595363**
NOx	**0.00615945**
ROG	**0.00092178**
SOx	**0.00002761**
PM10	**0.00028425**
PM2.5	**0.00020958**
CO2	**2.88143570**
CH4	**0.00003765**

Scenario Year: **2026**

All model years in the range 1982 to 2026

Passenger Vehicles (pounds/mile)	
CO	**0.00328779**
NOx	**0.00027141**
ROG	**0.00042052**
SOx	**0.00001076**
PM10	**0.00009687**
PM2.5	**0.00006415**
CO2	**1.11105829**
CH4	**0.00003518**

Delivery Trucks (pounds/mile)	
CO	**0.00569435**
NOx	**0.00589869**
ROG	**0.00088403**
SOx	**0.00002716**
PM10	**0.00027657**
PM2.5	**0.00020187**
CO2	**2.88298299**
CH4	**0.00003581**

Helicopter Emission Calculations

Emission Factor Derivation

Approach/Climbout (i.e. Working)

Equiv. Engs	Engine HP	Number	Emissions lbs/hour				
			HC	CO	NOx	SOx	PM
T53-L-11D	1100	1	0.20	2.04	5.00	0.04	0.27
T58-GE-5 (2)	1500	2	1.40	9.92	12.79	0.11	0.71

Note: SOx increased to assume 30 ppm sulfur Jet A fuel Sulfur Content

Idle	Engine HP	Number	Emissions lbs/hour				
			HC	CO	NOx	SOx	PM
T53-L-11D	1100	1	9.00	4.21	0.20	0.01	0.01
T58-GE-5 (2)	1500	2	25.86	45.12	0.40	0.02	0.03

Source: FAEED database

FAEED - FAA Aircraft Engine Emission Database

Relating Factors to Potential Construction/Operating Helicopters

Approach/Climbout	Engine HP	Number	Emissions lbs/hour				
			HC	CO	NOx	SOx	PM
530F	650	1	0.12	1.20	2.95	0.02	0.16
Hughes 500	420	1	0.08	0.78	1.91	0.02	0.10
Eurocopter	847	1	0.15	1.57	3.85	0.03	0.21
Skyking	1400	2	2.61	18.52	23.87	0.20	1.32
Skycrane	4500	2	8.40	59.52	76.74	0.64	4.25

Idle	Engine HP	Number	Emissions lbs/hour				
			HC	CO	NOx	SOx	PM
530F	650	1	5.32	2.48	0.12	0.01	0.01
Hughes 500	420	1	3.44	1.61	0.08	0.00	0.01
Eurocopter	847	1	6.93	3.24	0.15	0.01	0.01
Skyking	1400	2	48.28	84.23	0.75	0.03	0.05
Skycrane	4500	2	155.19	270.73	2.40	0.10	0.16

Assumptions:

Helicopters stay within 3000 feet of the ground.

Hours of Helicopter Use

Maximum Daily Hours of Helicopter use

Helicopter Type	**Working Hours**	**Idle Hours**	**Total Hours**
Project Modifications			
530F	7	3	**10**
Project			
Hughes 500[a]	5	0.5	5.5
Eurocopter[b]	147	15	162
Skyking[b]	62	6	69
Skycrane[b]	5	0	5
Project Total (w/o Project Modifications)			**241**
Project Total (w/ Project Modifications)			**251**

[a] The Hughes 500 helicopter is only used for conductor stringing. Hours of use are based on the calculations performed for the Final EIR and Final EIS, which assumed two helicopters in operation during line stringing for 2.5 hours per day each. It was assumed that stringing would occur on no more than one segment at a time.
[b] The Eurocopter, Skyking, and Skycrane are used for construction and wreck out activities. Maximum daily hours of use were taken from the Final EIR and Final EIS maximum daily helicopter emission calculations.

Maximum Daily Helicopter Emissions

Helicopter Type	**Total Emissions lbs/day[a]**				
	HC	**CO**	**NOx**	**SOx**	**PM**
Project Modifications					
530F	**16.78**	**15.89**	**21.04**	**0.18**	**1.15**
Project					
Hughes 500	2.10	4.69	9.58	0.08	0.52
Eurocopter	124.50	278.93	569.53	4.72	30.99
Skyking	463.78	1,679.28	1,492.84	12.56	82.76
Skycrane	44.78	317.45	409.28	3.40	22.67
Project Total (w/o Project Modifications)	**635.16**	**2,280.35**	**2,481.24**	**20.76**	**136.95**
Project Total (w/ Project Modifications)	**651.94**	**2,296.23**	**2,502.28**	**20.94**	**138.09**

[a] Total emissions Include working and idle emissions.

Total Hours of Helicopter use

Helicopter Type	Working Hours	Idle Hours	Total Hours
Project Modifications[a]			
530F	828	355	**1,183**
Project			
Hughes 500[b]	4,915	492	5,407
Eurocopter[c]	6,080	608	6,688
Skyking[c]	2,464	246	2,710
Skycrane[c]	512	0	512
Project Total (w/o Project Modifications)			**15,317**
Project Total (w/ Project Modifications)			**16,499**

[a] Assumes 2,365 marker balls installed, with the helicopter working 7 hours and idle 3 hours per day. This number is approximate, given the received and pending FAA recommendations to date and the FAA recommendations that SCE anticipates based on transmission line span characteristics and transmission structure characteristics. All pending FAA recommendations were assumed to require marking.

[b] Total hours of use were taken from the calculations performed for the Final EIR and Final EIS.

[c] Assumes total project helicopter construction of 96 towers and helicopter wreck out of 96 towers per construction schedule information as available in March 2012.

Total Helicopter Emissions

Helicopter Type	Total Emissions tons[a]				
	HC	**CO**	**NOx**	**SOx**	**PM**
Project Modifications					
530F	**0.99**	**0.94**	**1.24**	**0.01**	**0.07**
Project					
Hughes 500	1.03	2.31	4.71	0.04	0.26
Eurocopter	2.57	5.76	11.75	0.10	0.64
Skyking	9.17	33.19	29.51	0.25	1.64
Skycrane	2.15	15.24	19.65	0.16	1.09
Project Total (w/o Project Modifications)	**14.91**	**56.49**	**65.61**	**0.55**	**3.62**
Project Total (w/ Project Modifications)	**15.91**	**57.43**	**66.86**	**0.56**	**3.69**

[a] Total emissions Include working and idle emissions.

Helicopter Hours Calculations

Helicopter Construction

Assumptions:

1) Hughes 500 size helicopters are used during conductor installation for the proposed project, and two Hughes 500 helicopters are in operation during line stringing for 2.5 hours/day each.

2) Use of Eurocopter, Skyking, and Skycrane helicopters for helicopter tower site construction and wreck out are based on estimates provided by SCE.

3) Idle time is 10% of working time for Hughes 500, Eurocopter, and Skyking helicopters and negligible for the Skycrane.

4) Assumes helicopters stay within 3000 feet of the ground.

Wreck Out	Eurocopter		Skyking		Skycrane	
	Suspension	Dead-End	Suspension	Dead-End	Suspension	Dead-End
Site Preparation						
Personnel to Site	6	6	0	0	0	0
Brush Clearing	16	16	0	0	0	0
Temporary Heli Pad Construction	6	6	0	0	0	0
Soil Borings	0	0	0.5	0.5	0	0
Incidental	12	12	0	0	0	0
Conductor Removal						
Personnel to Site	4	4	0	0	0	0
Insulators &Hardware & Travelers	8	12	0	0	0	0
Unclip Conductor & OHGW	4	0	0	0	0	0
Break Tension/Sock Thru	0	4	0	0	0	0
Remove Jumper Loops & OHGW	0	4	0	0	0	0
Incidental	4	4	0	0	0	0
Excavate Foundation						
Personnel to Site	4	4	0	0	0	0
Tools & Equipment to Site	2	2	0	0	0	0
Equipment (Air Compressor)	0	0	2	2	0	0
Footing Steel Removal	0	0	4	4	0	0
Incidental	0	0	0	0	0	0
Suspension Tower Removal						
Personnel to Site	4	4	0	0	0	0
Tools & Equipment to Site	4	4	0	0	0	0
Tower Components	0	0	4	6	0	6
Incidental	4	4	0	0	0	0
Total Number of Trips per Tower S	78	86	11	13	0	6
Number of Tower Site	96	0	96	0	96	0
Total Number of Trips	7488	0	1056	0	0	0

Construction	Eurocopter		Skyking		Skycrane	
	Suspension	Dead-End	Suspension	Dead-End	Suspension	Dead-End
Foundations, Conventional Piers						
Personnel to Site	16	32	0	0	0	0
Tools to Site	6	12	0	0	0	0
Equipment (Air Compressor)	0	0	2	2	0	0
Spoil Removal	0	0	28	132	0	0
Rebar to Site	0	0	8	8	0	0
Stubs & Material to Site	8	8	0	0	0	0
Concrete to Site	0	0	28	120	0	0
Strip and Cleanup Site	8	8	0	0	0	0
Incidental	12	24	0	0	0	0
Tower Erection						
Personnel to Site	8	8	0	0	0	0
Tools to Site	4	4	0	0	0	0
Tower Components	0	0	0	0	16	24
Incidental	4	4	0	0	0	0
Conductor & OHGW Installation						
Personnel to Site	4	12	0	0	0	0
Install Insulators, Hardware & Travel	8	24	0	0	0	0
Clip-in or Dead-end Conductor	4	12	0	0	0	0
Space Conductor	6	0	0	0	0	0
Install Jumper Loops	0	6	0	0	0	0
Incidental	8	24	0	0	0	0
Site Restoration						
Personnel to Site	2	2	0	0	0	0
Remove Temporary Heli Pad	6	6	0	0	0	0
Cleanup Site & Restoration	8	8	0	0	0	0
Total Number of Trips per Tower S	112	194	66	262	16	24
Number of Tower Site	96	0	96	0	96	0
Total Number of Trips	10752	0	6336	0	1536	0

Assumptions in time period

	Min	Hour
to helicopter pod	5	0.08
from helicopter pod	5	0.08
load/trip	10	0.17

Total Required Time for Each Helicopter Round Trip

Helicopter Type	Working Hour/Round Trip	Idle Hour/Round Trip
Eurocopter	0.33	0.033
Skyking	0.33	0.033
Skycrane	0.33	0.000

Total Project Construction and Wreck out Helicopter Use

Helicopter Type	Working Hours	Idle Hours
Eurocopter	6080	608
Skyking	2464	246
Skycrane	512	0

Summary of Annual Project Modifications and NOx emissions in the ANF

Summary of Annual Project Modifications and NOx emissions in the ANF[a]

	2013	2014	2015
Number of Transmission Structures in the ANF Requiring Lighting[b]	0	8	0
Number of Marker Balls Required in the ANF[c]	591	439	191
Total NOx Emissions in the ANF from Project Modifications (tons/year)	0.64	0.48	0.21

[a] Includes marker balls and transmission structures located within the portions of TRTP Segments 6 & 11 that traverse the ANF.

[b] Average NOx emissions per transmission structure associated with lighting installation were determined to be 1.19 lbs based on the maximum daily emissions presented in the above table and the assumption that lighting would be installed on one structure per day.

[c] Average NOx emissions per marker ball for installation were determined to be 2.18 lbs based on the maximum daily emissions presented in the above table and the assumption that 20 marker balls would be installed per day.

Maximum Daily NOx Emissions From the Installation of Marker Balls (lbs)	43.63
Maximum Number of Marker Balls Installed Per Day	20
Average NOx Emissions Per Marker Ball (lbs)	2.18

Maximum Daily NOx Emissions From the Installation of Transmission Structure Lighting (lbs)	1.19
Maximum Number of Transmission Structures With Lighting Installed Per Day	1
Average NOx Emissions Per Transmission Structure (lbs)	1.19